

Chemistry is concerned with how one substance changes into another – how plants grow by absorbing H_2O and CO_2 , how humans manufacture the proteins we need to live from the food we consume, how smog forms in areas with high traffic, how the nylon for jackets and tents is made, etc. It is hard to believe, but our planet is made of only a little over 100 different types of atoms and it is these atoms that create the enormous diversity of things and behaviours on Earth.

From the study of chemistry, scientists have learned that:

- (a) all matter is made up of atoms,
- (b) substances change into other substances by reorganizing the way the atoms are attached to each other, and
- (c) it is the way that the atoms are organized in a given substance that determines the physical and chemical properties of the substance.

What is a physical property? Chemical property? Physical change? Chemical Change?

A *physical property* is a characteristic of a substance that can be observed without changing one substance into another, whereas a *chemical property* is a characteristic of a substance that is observed when that substance changes into a new substance. An example of a physical property is colour; an example of a chemical property is combustion.

A *physical change* involves the change in the appearance of a substance without the substance becoming something new, whereas a *chemical change* is a result of the substance being changed into a completely different material. As an example, ice melting is a physical change as the material is still water. However, when sodium is placed in water, the water reacts with the sodium and produces a new substance known as sodium hydroxide.

1. Indicate by means of a ✓, whether the description is that of a physical property (P), chemical property (C), physical change (PC) and/or chemical change (CC).

	(P)	(C)	(PC)	(CC)
<i>CaCl_2 has a melting point of 782°C</i>				
<i>CaCl_2 has a density of 2.15 g/cm^3</i>				
<i>CaCl_2 is soluble in water</i>				
<i>In the presence of sulfuric acid, CaCl_2 reacts to form HCl and CaSO_4</i>				
<i>When strongly heated, CaCl_2 produces chlorine gas</i>				
<i>Water boils in a kettle</i>				
<i>Propane burns in a barbecue</i>				
<i>An apple rots</i>				
<i>Water is transparent</i>				
<i>Steel has lustre</i>				
<i>Water can exist as a gas, a liquid, and a solid at the same temperature</i>				
<i>Aluminum can be pounded into thin sheets. It is malleable.</i>				
<i>Diamond scratches glass because it is harder than glass.</i>				
<i>Sand paper has a rough texture while silk is smooth</i>				

- In this course you will be required to make *qualitative* and *quantitative* observations. Which of the statements in question 1 would qualify as being qualitative (Q) and quantitative (QT)?
- What are the differences between a solid, a liquid, and a gas?
- What is the difference between a sample of matter that is *homogeneous* and one which is *heterogeneous*? Classify each of the following as homogeneous or heterogeneous:

soil, the atmosphere, Pepsi, gasoline, gold, Kool-Aid

- What is the difference between a *mixture* and a *pure substance*? Classify each of the following as either a mixture or a pure substance:

Water, Blood, Atlantic Ocean, Iron, Brass, Uranium, Wine, Leather, Sodium Chloride (Salt)

- What is the difference between *an element* and a *compound*? Of the pure substances listed in question 5, which are elements?
- Of the substances listed in questions 4 and 5, which would be considered *solutions*? What is the difference between a *solute* and a *solvent*?
- The properties of a mixture are typically averages of the properties of its components. The properties of a compound may differ dramatically from the properties of the elements which combined to create the compound. For each process below, state whether the material being discussed is most likely a mixture or a compound, and state whether the process is a chemical change or a physical change.
 - An orange liquid is distilled, resulting in the collection of a yellow liquid and a red solid
 - A colourless, crystalline solid is decomposed, resulting in a pale yellow-green gas and a soft, shiny metal
 - A cup of tea becomes sweeter as sugar is added to it
- Look carefully at the diagrams below. Decide whether each diagram represents an element, a compound, or a mixture. If the diagram represents a mixture, state how many elements and how many compounds are present in the mixture. Each different circle represents a different atom.



